



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/714,985	11/17/2003	William Hong	2003-0299/24061.514	2268
42717	7590	02/02/2005	EXAMINER	
HAYNES AND BOONE, LLP 901 MAIN STREET, SUITE 3100 DALLAS, TX 75202				NGUYEN, THANH T
		ART UNIT		PAPER NUMBER
		2813		

DATE MAILED: 02/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/714,985	HONG ET AL.	
	Examiner	Art Unit	
	Thanh T. Nguyen	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

**A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM
 THE MAILING DATE OF THIS COMMUNICATION.**

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 12 November 2004.
- 2a) This action is **FINAL**. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-19 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
 Paper No(s)/Mail Date 2/17/04
- 4) Interview Summary (PTO-413)
 Paper No(s)/Mail Date. _____
- 5) Notice of Informal Patent Application (PTO-152)
- 6) Other: _____

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 11/12/05 have been fully considered but they are not persuasive.

Information Disclosure Statement

The information disclosure statement filed on 2/17/04 has been considered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-19, 20-22, 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zutshi et al. (U.S. Patent No. 6,620027) in view of Tsai et al. (U.S. Publication No. 2003/0013306).

Referring to figures 2-3, Zutshi et al. teaches an oxide polishing, comprising:

(a) providing a substrate (110) having a top surface comprised of a copper layer (see col. 8, lines 37-47) area and a dielectric layer area (see col. 8, lines 37-47);

(b) performing a first oxide polishing step at a first polish station in a polishing tool by using a polishing pad and a slurry on a platen to contact the top surface of said substrate (see col. 9, lines 66-67, col. 10, lines 1-10);

(c) rinsing the substrate with DI water (col. 5, lines 56-67, and col. 7, lines 1-3);

(d) Performing a second oxide polishing step at said first polish station by using said polishing pad and a slurry (see col. 10, lines 32-42); and

(e) rinsing the substrate a second time with DI water ((col. 5, lines 56-67, col. 7, lines 1-

3). It is noted that it would be obvious to one ordinary skill in the art to polish and clean the second oxide layer for a second time with the same process as using in the first oxide layer to form a planar oxide layer and remove the contamination since it is well-known in the art to repeat the same process for multiple effect. See St. Regis paper, Co. V. Bemis Co. Inc. 193 USPQ 8, 11 (7th circuit 1977)

regarding to claim 2. The method of claim 1 wherein the top surface has been polished in one or more previous cmp processes (see figure 3, col. 11, lines 27-41).

Regarding to claim 4. The method of claim 1 wherein the top surface of said substrate is further comprised of a diffusion barrier layer area that includes one or more of TaN, Ta, Ti, TiN, WN, W, TaSiN, and TiSiN and is formed between said copper layer area (413) and said dielectric layer area (see col. 8, lines 37-67).

Regarding to claim 10. referring to figures 2-3, Zutshi et al. teaches a chemical mechanical polish (CMP) flow sequence for polishing a substrate with a top and bottom surface during the fabrication of a copper interconnect, comprising:

(a) providing a substrate (110) having an opening (called feature, see col. 8, lines 37-47)

with a top, bottom, and sidewalls formed therein, said opening is filled with a conformal diffusion barrier layer (see col. 8, lines 37-54) on the sidewalls and bottom of the opening and a copper layer (col. 9, lines 37-47) on said diffusion barrier layer wherein said diffusion barrier layer and copper layer extend above the top of said opening and the top surface of the substrate is comprised of a copper layer area at the top of the copper layer to be polished (see col. 8, lines 37-67);

(b) performing a first CMP process at a first polish station using a polishing pad and a slurry on a platen to remove a portion of the layer so that the polished copper layer becomes coplanar with said diffusion barrier layer, said substrate is held by its bottom surface on a head that has a down force and a rotational speed (see, col. 11, lines 1+).

(c) performing a second CMP process at a second polish station using a polishing pad and a slurry on a platen to remove a portion of the diffusion barrier layer and a portion of the polished copper layer so that the polished diffusion barrier layer and the twice polished copper layer become coplanar with the top of the opening, said substrate is held by its bottom surface on a head that has a down force and rotational speed; (see col. 11, lines 57-67, col. 12, lines 1-50)

(d) performing a third CMP process which is an oxide polishing process at a third polishing station using a slurry and a polishing pad on a platen to form a smoother top surface comprised of a diffusion barrier area at the top of the polished diffusion barrier layer and a copper layer area at the top of the twice polished copper layer, and to remove residues from previous CMP processes, said substrate is held by a head that has a down force and a rotational speed (see col. 12, lines 51-67) and wherein said third CMP process comprises:

- (1) performing a first oxide polishing step;
- (2) rinsing the substrate with DI water;
- (3) performing a second oxide polishing step; and

(4) rinsing the substrate a second time with DI water.). It is noted that it would be obvious to one ordinary skill in the art to polish and clean the second oxide layer for a second time with the same process as using in the first oxide layer to form a planar oxide layer and remove the contamination since it is well-known in the art to repeat the same process for multiple effect. See St. Regis paper, Co. V. Bemis Co. Inc. 193 USPQ 8, 11 (7th circuit 1977) regarding to claim 18. The method of claim 10 wherein the first CMP process, second CMP process, and third CMP process are performed in the same CMP tool which is integrated with a spin-rinse dryer module to dry the substrate (see figure 2, cols. 5-7).

Regarding to claim 19. The method of claim 10 wherein the CMP flow sequence is implemented as pad of a damascene process and the damascene process is performed a plurality of times on a substrate to fabricate a plurality of copper layers that form a stacked copper structure. It is noted that it would be obvious to one ordinary skill in the art to perform plurality CMP flow to form a plurality of copper layer since it is well-known in the art to repeat the same process for multiple effect. See St. Regis paper, Co. V. Bemis Co. Inc. 193 USPQ 8, 11 (7th circuit 1977).

Regarding to claim 20, a method for chemical mechanical polishing (CMP) a semiconductor substrate with one or more exposed copper areas and one or more exposed oxide layers on a top surface of the substrate, the method comprising:

Performing a first polishing operation on the exposed oxide layer using a first slurry (see col. 9, lines 66-67, col. 10, lines 1-10);

Performing a first rinsing operation of the top surface of the substrate (col. 5, lines 56-67, and col. 7, lines 1-3);

Performing a second polishing operation on the exposed oxide layer using a second slurry (see col. 10, lines 32-42); and

Performing a second rinsing operation of the top surface of the substrate ((col. 5, lines 56-67, col. 7, lines 1-3). It is noted that it would be obvious to one ordinary skill in the art to polish and clean the second oxide layer for a second time with the same process as using in the first oxide layer to form a planar oxide layer and remove the contamination since it is well-known in the art to repeat the same process for multiple effect. See St. Regis paper, Co. V. Bemis Co. Inc. 193 USPQ 8, 11 (7th circuit 1977).

Regarding to claim 21, the steps are performed on a first head and platen of a CMP system (see figure 2, cols. 5-7).

Regarding to claim 22, performing a third polishing operation on the exposed copper area with a third slurry on a second head and platen of the CMP system prior to the first and second polishing operation (see col. 12, lines 51-67).

However, the reference does not teach first oxide polish step and said second oxide polishing step are performed in a CMP tool with a slurry comprised of silica, water, and one or more additives that has a pH of about 7 to 10, The temperature range, speed range, flow rate range, time range, pressure range.

Regarding to claims 3, 11, 24, Tsai et al. teaches method of claim 1 wherein said first oxide polish step and said second oxide polishing step are performed in a CMP tool with a slurry comprised of silica, water, and one or more additives that has a pH of about 7 to 10 (see paragraphs# 41, 48-49 of Tsai et al.). About permits some tolerance. At least about 10% was held to be anticipated by a teaching of a content not to exceed about 8%. *In re Ayers*, 154 F2d 182, 69 U.S.P.Q. 109 (C.C.P.A. 1946). *In re Erickson*, 343 F 2d 778, 145 U.S.P.Q.207(C.C.P.A 1965).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would polish first oxide polish step and said second oxide polishing step are performed in a CMP tool with a slurry comprised of silica, water, and one or more additives that has a PH of about 7 to 10 in process of Zutshi et al. as taught by Tsai et al. because the process would provide a planarizing substrate surface with reduced or minimal residue.

The temperature range, speed range, flow rate range, time range, pressure range specifically in claims 5-9, 12-17 are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted *In re Aller*, the selection of reaction parameters such as temperature and concentration would have been obvious:

ANormally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed Acritical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. \cong

In re Aller 105 USPQ233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmscher* 66 USPQ 314 (CCPA

1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Therefore, one of ordinary skill in the requisite art at the time the invention was made would have used any temperature range, speed range, flow rate range, time range, pressure range suitable to the method in process of Tsai et al. in order to optimize the process.

Allowable Subject Matter

Claim 23 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. None of the prior art alone or in combination teaches the subset of the method for chemical mechanical polishing the semiconductor substrate with one or more exposed copper areas and one or more exposed oxide layer on a top surface of the substrate includes an exposed barrier layer after the polishing of the exposed copper comprising: performing a fourth polishing operation on the exposed barrier layer with a fourth slurry on the fourth head and platen of the CMP system prior to the first and second polishing operation and after the third polishing operation.

Response to Arguments

Applicant's arguments filed 11/12/05 have been fully considered but they are not persuasive.

Applicant fails to argue that the process limitations in the claimed invention differs from the cited references. Merely argue that the rule of 103 rejection over the MPEP does not make the claimed invention allowable. Examiner has combined and clearly points out teachings of an oxide polishing process, such as performing oxide polishing step and rinsing the substrate with DI water and in the auxiliary reference that polishing the oxide film by using the polishing tool. Accordingly, it would have been prima facie obvious that performing oxide polishing step and rinsing the substrate with DI water and in the auxiliary reference that polishing the oxide film by using the polishing tool. Therefore, Examiner has clearly pointed out where critical method step limitation is present in all of cited references and therefore meets the burden under 35 USC § 103 to establish a prima facie case of obviousness.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (See **MPEP 203.08**).



Thanh Nguyen
Patent Examiner
Patent Examining Group 2800